

## Summary

With worldwide cargo shipping on the rise, vessels are becoming larger and larger, the current record holder being the Maersk E class, with over 14000TEU. With the completion of the new Panama canal on the horizon, Post-Panamax vessels will most likely take this even further. While the vessel size is constantly increasing, the shipping companies want the turnaround time of the vessels to be the same, or preferably even lower.

This encourages the container terminals to look for ways to increase their throughput, while still remaining a profitable enterprise. For this reason container terminals all over the world are looking for ways to fully, or partially, automate the processes which are required to quickly load and unload container vessels. Besides simply increasing their throughput, there are several other reasons why a terminal might consider automation, some reasons include:

- Reducing labour costs
- Eliminating potentially dangerous working environments
- Improving productivity

In this literature study the focus will be on the automation of STS container cranes, which play a vital role in any container terminal. Since there is only a limited amount of spaces available alongside a quay, the post Panamax vessels can't simply be unloaded quicker by adding more cranes. Therefore the cycle speed and crane productivity will have to improve.

The main function of a STS container crane is to transport containers from the yard to the vessel or vice versa. In order to achieve that function a lengthy string of actions have to be taken, which almost all have to be performed in a very linear order. One way of trying to go around that linear order of actions, is by decoupling the actions at one or more points, allowing them to be performed somewhat parallel to one another. This can be achieved through the use of various double trolley cranes. Or some of the newer crane concepts which utilize continuous container transfer.

Another possible way to improve productivity is by implementing double cycling. Double cycling is where a crane unloads an import container and returns to the vessel with an export container. By doing so reduces empty crane spreader travel, which improves crane and port productivity.

One way of increasing a cranes productivity is through the use twin, or even triple lift spreaders. As well as using additional systems which assist the crane operator in his actions, and possibly prevent dangerous situations. Automated Lashing Platforms are also capable of eliminating dangerous working environments, since they remove the need for lashers to work close to moving containers.

There still is a long way to go before the current container terminals will be fully automated, this won't happen yet in the upcoming years. What we do expect to happen, and what is already happening, is that semi-automation will continue to get implemented.

When trying to automate the container cycle, two different type of challenges have to be faced. The first being of a technological nature, which technological barriers do we still have to overcome for full automation. The second being of a human nature, crane operators take pride in their job and would hate to lose their job due to automation. As such they will resist attempts to automate the (un)loading process.

Further research should be done in order to find out which aspects are currently holding back the implementation of fully automated STS container cranes, or remotely operated STS container cranes. And what would be needed in order to overcome those problems.